DOCUMENT RESUME

ED 124 111 IR 003 480

TITLE	Video Tape Recording and Film: Description and Comparison with a View to Their Application in Audio-Visual Programs in Bangladesh.
INSTITUTION	Asia Foundation, New York, N.Y.
PUB DATE	Jun 75
NOTE	48p.
EDRS PRICE	MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS	Climatic Factors; Comparative Analysis; Costs; Developing Nations; *Equipment Standards; *Films; Humidity; Instructional Films; *Physical Environment; Temperature; *Video Tape Recordings
IDENTIFIERS	Bangladesh; Sixteen Millimeter Films; Super 8 Films

ABSTRACT

This monograph compares the advantages, limitations, and liabilities of videotape recording, 16mm, and 8 systems with special consideration to their deployment in the tropical conditions that prevail in Bangladesh. The first part of the text is a comparison of the three systems. Both video and film systems are discussed in terms of their technical operation and precautions necessary to insure their proper functioning. The appendixes provide cost estimates on media equipment, a list of media equipment repair facilities in Bangladesh, and a list of information sources on media. (EMH)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED124111

VIDEO TAPE RECORDING AND FILM:

DESCRIPTION AND COMPARISON

WITH A VIEW TO THEIR APPLICATION

IN AUDIO-VISUAL PROGRAMS IN BANGLADESH

Prepared for

The Asia Foundation, Bangladesh

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

By

Benedict Tisa, Media Consultant

International Voluntary Services

Dacca, Bangladesh

June 1975

All addresses and names of suppliers are current as of June 1975

IR 003 480

TABLE OF CONTENTS

	Page
Introduction	1
Bangladesh Climate, Temperature, R.H. Recommendations ...	2
Schematic Comparison of VTR, 16mm and Super 8 ...	2
Video Tape Recording:	
What is VTR?	8
The Video Camera	9
The Video Tape Recorder	10
Magnetic Video Recording Tape	10
Care and Handling of the VTR: The Camera ...	10
Care and Handling of the VTR: The Recorder ...	11
Care and Handling of the VTR: The Monitor ...	12
Care and Handling of the VTR: Cables ...	12
Care and Handling of the VTR: Magnetic Recording Tape	13
Dropouts	14
Cassette Systems	14
Standardization and Compatibility	14
Storage and Protection of Magnetic Recording Tape ...	15
Video Tape Editing	15
The Recording Area	16
An Abbreviated Comparison of VTR and Film ...	16
Film:	
Film	16
Movie Cameras	17
Care and Handling of the Camera	17
Care and Handling of Lenses	18
Film Editing	19
Sound Editing - Wild Sound	20
Sound Editing - Lip Sync	20
Film - Causes of Damage	21
Film - Precautions and Care	21
Film Splices	22
Film Storage	23
Appendices:	
A. A note on Expenses and Estimated Costs ...	24
VTR: Estimated Costs for Black & White Portable System	25
VTR: Estimated Costs for Color Cassette Video System	25
Film: Estimated Costs for Low-Budget Super 8 Sound System	26
Film: Estimated Costs for MIT-Leacock Super 8 Double System Sync Sound	26
Film: Low-Budget 16mm System	27
Super 8: Sample Production Costs for 20-Minute Movie	27
16mm Low-Budget: Sample Production Costs for 20-Minute Movie	28
16mm Professional: Sample Production Costs for 20-Minute Movie	28

B. A Note on Addresses of Repair Facilities and Equipment Suppliers 29
VTR Repair Facilities Convenient to Bangladesh ... 29
VTR Equipment Manufacturers 29
Camera Repair Facilities Convenient to Bangladesh ... 30
16mm Equipment Manufacturers 31
Super 8 Equipment Manufacturers 31

C. A Note on Sources of Information 32
Useful Addresses 32
Useful Periodicals 33

Bibliography 43

INTRODUCTION

This brief description and comparison of selected media equipment, with an emphasis on environmental conditions in Bangladesh, is intended for the layman -- for the person whose field of expertise isn't media equipment, but who sees the value of its application in developmental programs. This report is not meant to be a "manual" or "technical work." For those interested in in-depth information, there is a profusion of books, magazines and organizations that can provide the reader with the information he desires. Rather, this report is meant to serve as a departure point for those persons or organizations wishing to investigate the feasibility of utilizing video tape or film systems.

People are often unduly impressed by the high level of sophistication of the machinery utilized in both visual systems (VTR, Film), tending to equate that with the high level of information they wish to transmit. A more expensive and sophisticated product does not always mean the best method of imparting information. And one's initial investment in A-V hardware is not limited to those first pieces of equipment. In climatic and geographical conditions such as Bangladesh presents, there are additional factors to consider: logistical support, sturdiness of equipment, humidity, heat, dust, heavy rains, poor roads, inexperienced operators and virtually non-existent repair facilities -- these all contribute to the difficulty and costs of establishing and maintaining an audio-visual system. If work and storage conditions are properly kept up, and the equipment given regular maintenance, the working life of the equipment will be considerably extended, no matter what the environmental conditions. But these precautions also add hidden costs to the initial investment. The proper functioning of certain types of equipment requires more stringent measures than others. This is where budget will be a deciding factor. For an organization with unlimited funds could use VTR very effectively and creatively because it could provide the needed support of air conditioners, extra monitors, etc. With only a few thousand dollars to spend, another organization might opt for film, since it could be sure of maintaining the equipment adequately to perform the tasks at hand.

VTR, 16mm and Super 8 systems all have their limitations and liabilities, just as each has its inherent advantages. The most important advantage of all three is their ability to reproduce images and movement in such a way as to impress the viewer that he or she is actually there. The viewer can go anywhere the camera can go, into cities, to local farms, to hospital operating rooms, to mountains, under the oceans. The images can also create their own time/space effect: flowers bloom in a minute. Time can be stretched or condensed. The uses and value of film and video are limitless in the hands of creative and inventive people. It only remains to choose the system best suited to the capabilities of the organization employing it, and the needs of the information to be transmitted.

To this end this monograph is intended. It is divided into several parts. The first part is a comparison chart of the three systems, which should give the reader a general idea as to how they function and relate to one another. Then, there follows a short discussion about what VTR is, how it works, and the precautions necessary for its reliable functioning -- all this with a special view to the exigencies of the tropical conditions prevailing in Bangladesh. In the following sections, film is treated in the same way. In the Appendices, the reader will find cost estimates on media equipment, as well as examples of the costs for 20-minute productions in video, 16mm and Super 8. The addresses of repair facilities convenient to Bangladesh are listed (this list will also give the reader an idea of the patterns of use of these systems in this part of the world, since wherever there is an increase in use, there follows a rise in the number of repair facilities serving the hardware). Another list gives the addresses and names of other sources of information that may be of help, followed by a list of periodicals which specialize in media hardware and software, and finally, a short bibliography.

The comparison charts, the general discussion, the cost estimates and lists of sources of additional information should make it possible for any interested person to make his own valid decision as to which system will best suit his needs.

Bangladesh climate:

85 inches per year average rainfall
90% humidity during monsoons
98° to 102° in summer
55° to 70° in winter
80° average mean temperature
AV 220 volts, 50 cycles

Ideal conditions for VTR equipment:

Temperature in the 70's
Relative Humidity about 50%

Recommended conditions for magnetic tapes:

Temperature between 60° and 80°
Relative Humidity between 40% and 60%

Best conditions for handling film:

Temperature between 65° and 70°
Relative Humidity about 50%

Recommended conditions for film storage:

Temperature between 40° and 50°
Relative Humidity 40%
Mould growth is encouraged if RH rises above 60%

SCHEMATIC COMPARISON OF VTR, 16mm and SUPER 8

1. Expense*

VIDEO TAPE

Black-and-white camera, recorder, monitor system costs about $2000 to $3000. Editing equipment (a second deck) can add another $1000 or more.

Video tape costs about $20 per 20 minutes running time. Tape can of course be erased and reused many times.

Color video systems run into the thousands of dollars.

Cassette systems are more complex and have a higher cost than other VTR units.

Maintenance is costly and necessary.

16mm

Expensive. Cameras run from $1000 with lenses. More expensive models can cost $5000 to $6000 without lenses. Lenses are from $500 to $1500, depending on makes and models.

Editing equipment starts at about $100, but can also be very costly, depending on capabilities desired.

Projectors from $500 to $1500.

Color film costs about $70 for 700 feet, or 20 minutes. Processing for same would be an additional $50 or $60. A work print runs another $100. An optical sound track another $40 or $50. Total costs so far for 700 feet, about $300 at the ratio of 1:1. However, normal shooting to screen ratio is 3:1, so that for 20 minutes of film screened, about 2100 feet of film would have to be shot, tripling costs to about $900. Other costs enter such as magnetic stock for sound. All estimates are based on Statside prices.

Maintenance is inexpensive, compared to VTR.

SUPER 8

A high-quality camera such as Nizo or Bauer, and recorder-projector will cost about $1500. Editing equipment runs from $20 for a simple rewind-viewer type, to $500 and up for a flat-bed type editing table. $7000 can buy a complet professional outfit: camera, recorder, editor, projector (Leacock system).

Film costs about $57 per 20 minutes, plus another $50 for processing. The film would have to be striped for sound at a rate of 4¢ to 6¢ per foot. Total cost for 20 minutes would be about $140. Again, this is on a 1:1 ratio of shooting footage to screen foot-age. More normal costs would be about three times as much.

Maintenance is the least expensive of the three.

*See Appendix A.

2. Editing

VIDEO TAPE

Video tape editing is time-consuming and complicated. Equipment is expensive and delicate.

Editing requires the added expense of a second video deck.

Editing must be done electronically. Tape cannot be cut and spliced in the same manner as film, or the picture will break up with every splice.

Picture and sound are on the same tape, therefore sound transfer is not necessary.

Special effects, such as dissolves, fades, superimpositions and titles must be done with a Special Effects Generator. A low-cost SEG runs from $600 to $1000 above the cost of the editing equipment.

16mm

Simple editing (without sound) is relatively uncomplicated, but takes practice. Sync sound editing is more complex.

Basic 16mm editing equipment is more expensive than Super 8, but less than VTR.

Sound must be transferred from ¼ inch magnetic tape to film optical. This must be done in a lab.

Various visual effects (fade-in, fade-out, dissolve, stop-frame, superimposition, titles, etc.) are possible at a lab or with certain models of cameras.

A&B checkerboard editing requires spliceless prints from a lab.

SUPER 8

Simple editing (without sound) is relatively uncomplicated, but takes practice. Sync sound editing is more complex.

Super 8 editing equipment is relatively inexpensive.

Picture and sound are separate mediums and must be transferred to a final print. In a Single 8 system, sound is recorded directly on the film. Specially-designed cameras and film cartridges are available for this.

Super 8 is not as flexible as 16mm. However, more labs are offering services similar to those for 16mm. The more expensive models of cameras can also make their own special effects.

3. Playback

VIDEO TAPE

Instant playback.

Standardization of VTR equipment is not universal. For playback, equipment must be compatible. Japanese reel to reel types are interchangeable. But most video cassette types work only with the unit on which they were recorded.

Video tape can be erased and re-recorded.

Unless a video program is broadcasted, the audience is limited to the number of people who can sit around a monitor: 10-15.

16mm

Delay between shooting and playback due to necessity of processing film.

USA standard playback time is 24 frames per second. European standard is 25 fps.

16mm film can be shown on all 16mm projectors. No problem with interchangeability.

Film is permanent and cannot be erased or re-used.

Film reaches a theater-sized audience (over 100 people).

SUPER 8

Delay between shooting and playback for film processing.

Equipment is standard, 18 fps for silent films; 24 fps for sound-synchronized films.

No compatibility problems. Super 8 films can be shown on any Super 8 projector.

Super 8 film can be viewed by a medium-sized audience (under 100 people).

4. Portability

VIDEO TAPE

Portapaks are heavy (25-30 lbs). Though manageable, they become awkward to handle for extended periods of time.

Portable cameras are small, on a par with Super 8, but recorder units are heavy.

Studio units are not portable and require tripods at all times.

16mm

Weight varies according to the model, but in general, 16mm equipment is lighter than portable video units.

Cameras are much larger than portable VTR or Super 8 cameras.

SUPER 8

Very portable and compact, even with synchronized sound recorder attached. 5-10 lbs., depending on type of camera and sound recorder.

Cameras are small and light.

5. Noise

VIDEO TAPE

Silent.

16mm

Degree of noise depends on price. High-priced models are practically noiseless (an important consideration in sync-sound shooting). Spring-wound models make a considerable amount of noise.

SUPER 8

Even low-priced cameras are relatively silent and can be used while recording sound.

6. Reliability and Maintenance

VIDEO TAPE

Reliability is questionable. Very delicate machine, extremely sensitive to dust and humidity. Tolerances very critical.

Maintenance is complex. Machine needs frequent adjustment. Long periods of time while in repair shop.

Repair is expensive and time-consuming.

Cassette systems may need even more stringent maintenance measures, as they are more complex than reel to reel.

16mm

Reliability is good. Equipment is sturdy, can take rugged use.

Maintenance is minimal, though routine maintenance is necessary. If kept clean, will give good service for years.

Repair is not as expensive and time-consuming as for VTR equipment.

Large network of repair facilities worldwide.

SUPER 8

Reliability is good. Will give good service with little expense.

Maintenance is minimal. Routine cleaning and servicing necessary.

Repair is not as expensive as for 16mm, but may take more time. Super 8 equipment usually has to go to the factory for repair.

7. Color Availability

VIDEO TAPE

Black-and-white units most commonly used. Color available, but much more expensive.

16mm

Both color and black-and-white available.

SUPER 8

Both color and black-and-white available.

8. Raw Stock

VIDEO TAPE

Most common portable VTR uses ½-inch magnetic tape. Tape also available in ¼-inch, 1-inch and 2-inch widths.

Portable units reels run 20 min. Studio recorder reels run longer.

Sound and image are recorded simultaneously, in sync, on the same tape.

Magnetic tape available on reels or in cassettes.

16mm

16mm film (its width is 16mm) comes in lengths of 50 feet and longer, depending on camera capabilities.

Film comes in negative stock, or reversal stock (which can be shown immediately upon being processed).

ASA from 16 to 500 in color, but certain types can be pushed to 1000 for low-light capabilities. Black-and-white can be pushed to 1600.

Extremely wide variety of films to meet differing requirements.

Film also available which has been already sound-striped, to be used with cameras that recorded directly in the film.

SUPER 8

Available in rolls and in cartridges. 50-foot cartridges are the most common.

ASA in 25, to 160 for color. Plus-X and Tri-X for black-and-white.

Selection of Super 8 films is limited compared to 16mm. However, since it is considered an amateur film, it can usually be purchased more easily and in more places than VTR tape or 16mm film.

Super 8 cartridges with sound striping are available for single-system sound Super 8.

9. Running Time

VIDEO TAPE

Portapak standard size unit reels run 20 minutes without having to be changed.

Studio model reels vary in length.

16mm

50 ft. roll 4 min. 23 sec., 100 ft. roll 2 min. 47 sec., 200 ft. roll 5 min. 33 sec., 400 ft. roll 11 min. 7 sec. All times are at 24 frames per second, which is the proper speed for sound synchronization.

SUPER 8

50 ft. cartridge - 3 min. 20 sec. at 18 frames per second, 50 ft. cartridge - 2 min. 30 sec. at 24 frames per second.

10. Power Requirement

VIDEO TAPE

Requires a constant and well-regulated power supply, voltage and frequency.

Portable units can be run on rechargeable batteries. Running time per charging is ½ hour.

Equipment must be matched to local supply requirements: 60 cycles, 120 V; or 50 cycles, 220 V.

16mm

Uses rechargeable power packs. Runs on DC.

Some models are spring driven.

Much more tolerant to variations in power supply than VTR equipment.

SUPER 8

Runs on self-contained battery. Some models have rechargeable batteries. Most use penlight batteries, which can be obtained almost anywhere.

11. Effect of Humidity

VIDEO TAPE

Humidity is very detrimental to the critical tolerances of VTR equipment. Deposits of water can cause shorts, oxidation of certain metals. Components can change their electrical characteristics as they absorb moisture.

Equipment should be kept at a normal relative humidity of 50%.

Helical scan equipment is particularly prone to humidity problems, however the quadruplex units are designed inherently to be less affected by high humidity.

16mm

Humidity causes corrosion of metal parts. High humidity along with high temperatures causes fungus growth. If cameras are regularly cleaned and maintained they can give reliable use.

Projectors are subject to electrical failures and corrosion.

Film is affected by high humidity due to its property of absorbing moisture from the surrounding atmosphere. It is best handled at a relative humidity of 40-50%. High humidity and temperatures combined cause fungus growth on film. Some provision for the reduction of humidity is necessary for film and equipment.

SUPER 8

As with VTR equipment and 16mm equipment, humidity can cause fungus growth on lenses. Though not as sensitive as VTR equipment, many Super 8 models are equipped with complex electrical systems and these can be affected by the absorbtion of moisture from the air.

12. Effect of Dust

VIDEO TAPE

Dust is probably the worst enemy of VTR equipment.

VTR equipment absolutely must be cleaned before and after each use.

A thorough break-down cleaning is fairly difficult.

16mm

Dust in the camera may cause scranches on the film, and clog working parts. Though 16mm equipment has more tolerance to dust than VTR equipment.

Cameras should be regularly cleaned after every roll of film.

A thorough basic cleaning is fairly easily accomplished.

SUPER 8

It is more difficult to clean critical areas of rear-loading Super 8 cameras than 16mm cameras.

13. Temperature Tolerances

VIDEO TAPE

The most favorable working environment for video equipment is about 50% relative humidity and 70°F. VTR equipment should not be operated in extreme condition. Overheating must be avoided while the equipment is running. Direct sun can melt some of the components of video cameras.

While magnetic tape can stand a relatively high or low temperature, frequent temperature changes can damage the tape.

16mm

Cameras operate best in moderate temperatures. Cameras should be tropicalized. When properly taken care of, cameras can work well in extremes of temperature they are adapted to. 16mm cameras have been used in almost every conceivable environment.

Film is particularly sensitive to heat, and dye changes may result.

Proper storage facilities are necessary. Films should be stored at about 65°.

16mm is much more resistant than VTR equipment.

SUPER 8

Since there are many more plastic components in Super 8 cameras, the risk of melting in direct sunlight is much greater than for 16mm cameras. In electronic cameras tolerances can change more readily and cause damaging friction.

High quality cameras are on a par with 16mm equipment.

14. Low Light Capabilities

VIDEO TAPE

Extensive low-light capabilities. Some loss of image quality at extremely low levels.

16mm

Reasonable capabilities due to choice of film.

Film, in the processing, may also be pushed beyond its original rating, though there may be a noticeable graininess in the print.

SUPER 8

Reasonable capabilities, Ektachrome 160 being the most sensitive film available. This film used with an XL camera can give quite acceptable images.

Super 8 film suffers when pushed beyond its original rating.

15. Loading

VIDEO TAPE

Most models require reel to reel threading. Cassette units are also available.

16mm

Most models must be threaded. Instant loading magazines available for some cameras. Film magazines are made to hold various lengths of film.

SUPER 8

Instant loading 50-foot cartridges are standard.

Some models have provision for magazine loading.

16. Exposure

VIDEO TAPE

Manual and automatic.

16mm

Manual and automatic

SUPER 8

Manual and automatic.

WHAT IS VTR?

A video tape recording system looks like a TV crossed with a tape recorder. It's really a combination of both with the benefits and qualities of both.

How does the VTR work? Though the portable camera is about the same size as a Super 8 movie camera, it contains no film. Instead, there is a vidicon tube which records its subject electronically (unlike movie film which involves a chemical process). The camera is pointed at the subject and the image is transmitted through the lens to the vidicon tube. There, it is changed into electrical impulses that travel through cables and connectors to a set of rotating tape heads in the recorder. As the magnetic tape passes over these heads, the image in magnetic patterns is transferred onto it in a tracking

manner. By reversing the process, these taped pieces of information which form the image and sound can be transmitted to a TV receiver screen, or monitor. Just as audio recording tape can be played over and over, or erased and re-recorded, so with video recording tape. It's a very immediate process, unlike film; you can see immediately what you've just recorded.

Of course, behind all this amazing efficiency and fun is a lot of very complex and delicate machinery. It is neither simple to operate nor to maintain. It is well to have some fundamental knowledge of the components of a VTR system before one thinks of investing in it, or devising programs for its use.

Basically, there are four components to any video recording set-up: the camera, the recorder, the monitor, and an assortment of plugs and connectors. (The editing and other pieces of specialized equipment will be discussed later.)

THE VIDEO CAMERA

There are two types of video cameras, the viewfinder camera, and the non-viewfinder camera. The viewfinder camera enables the cameraman to see the picture as the camera "sees" it on a small screen built into the camera. The size of the screen varies with the make and model of the camera. Most portable, hand-held cameras will have a 1-inch screen. Larger, studio-type cameras will have a 3-inch to 5-inch screen. The non-viewfinder camera, as the name implies, has no monitoring screen. It costs much less than the viewfinder camera and is used mainly for unmanned surveillance.

In appearance, the lenses on most cameras are very much like cinema lenses and are equipped with the standard screw-on "C" mount. Indeed, 16mm lenses can be used with most video cameras.

The vidicon tube inside the camera is responsible for the light sensitivity of the camera, the sharpness and clarity of the picture and whether the picture will be in black-and-white or color. The black-and-white camera will have one tube, while the color camera may have three or four. Vidicon tubes cost from $75 and up, the average cost being around $250. Under normal wear, they have a lifespan of 3,000 to 5,000 hours.

The average portable video camera (as opposed to studio models) is about the size and shape of a Super 8 camera, and is handled in much the same fashion. It has the built-in monitor which allows you to see what you are recording while you are recording it. A microphone, usually built-in above the lens, records automatically whenever the camera is in operation. It makes for quite a compact unit, which is connected to the recorder through special cables.

Tripod-mount cameras require the utilization of an external microphone, and are usually not very portable. Even larger models designed for a small broadcast studio, educational TV, and industry include the Sony AVC 3200 (with detachable viewfinder/monitor) and the AVC 4200A. These are considerably more expensive units.

THE VIDEO TAPE RECORDER

Recorders can be classified into three different types. The most common are the helical scan recorders, used for educational purposes in schools, and by industry and private persons for a multiplicity of purposes. Other types include the quadruplex recorders, large and expensive, used primarily in broadcasting studios, and disc recorders, used for slow-motion replays on television and for specialized scientific purposes.

The name "helical scan" comes from the way the magnetic recording tape is wrapped about the drum on a slightly slanted path. A pair of rotating heads create a varying magnetic field which is recorded onto the tape passing about the drum head. For playback, these same heads pick up the recorded impulses and convert them electronically back to the original sounds and images. This extremely complex process all takes place within a millionth of a second. Through cords and connecting cables, sound and images are transmitted from the recorder to a monitor, which is nothing more than a small television adapted for VTR use.

MAGNETIC VIDEO RECORDING TAPE

We've been talking about VTR tape. What is it? It looks a lot like audio recording tape only wider. In reality it is polyester base film with an oxide coating made up in most cases of gamma ferric oxide, which is a form of iron oxide. Other kinds of tape are made up of chromium dioxide or cobalt-doped iron oxide. On the back side of the tape is a carbon coating, whose purpose

is to help improve rewinding by giving a relatively rough surface so that no air will be trapped between layers of tape. This layer of roughness also provides a resistance to cinching. The carbon also reduces the electro-static attraction of dust and other airborne particles. On the oxide-coated side of the tape the information received from the recorder heads is stored magnetically. The audio and video signals are sent simultaneously through the recorder and magnectically stored on the tape. The sound impulses usually go at the top of the tape, and the visual impulses in the middle. The sync, or control, band is at the bottom. This sync, or control, band is a very important part of the

VTR system. It is to video tape what sprocket holes are to film, in the sense that it keeps the image and sound properly inter-locked, the picture stable and clear, and the tape moving at the proper speed. Without sync, the information stored on the tape would just be a jumble of random lines and sounds.

CARE AND HANDLING OF THE VTR: THE CAMERA.

The vidicon tube is the most critical component of the video camera. It is also very sensitive and can be damaged in several ways. Its replacement could require the expenditure of $100 or more. It will, of course, wear out in time, but with regular care it should last 3,000 to 5,000 hours of use.

When the camera is not in use, the lens should always be capped and in the "C" or closed position. The vidicon is extremely sensitive to light and can be easily burned. Even when the camera is turned off, it should never be pointed at the sun or any bright, intense light source, nor should it be pointed at any bright, white surface (such as a wall) for an extended period of time.

Neither the camera or recorder should be subjected to high temperatures. They shouldn't be left in the sun, or in a vehicle on a hot day. Though VTR equipment can tolerate temperatures from 32° to 104°, they should not be subjected to extremes of temperature, if possible, or to frequent changes of temperature.

The vidicon can also be ruined by rough handling or mechanical shock. If subjected to a great deal of vibration, minute particles will be shaken onto the face of the tube and contaminate it, causing black spots to appear in the picture. For this reason, the camera should never be stored face-down.

The lens elements and vidicon should be carefully cleaned with lens-cleaning tissue or compressed air. These surfaces should never be touched with the fingers, and the camera should always be turned off while cleaning. The proper care of lenses is more precisely described in the section on movie cameras, since the effect of the environment as well as care and precautions are essentially the same for both.

All cameras and recorders should be stored in tightly-sealed, foam-lined aluminium cases. These will help protect the equipment from dust and dirt, absorb the shock in transit, and reflect the sun away from the equipment inside, keeping it cooler. Some types of cases are hermetically sealed. These have the added attraction of keeping humidity out.

CARE AND HANDLING OF THE VTR: THE RECORDER.

The VTR unit is a machine of extreme electronic complexity. Some of the physical processes of recording occur in millionths of a second and are repeated continuously during recording and playback. Obviously this calls for extreme precision of the different components, whose alignment with one another is critical and must be kept within microscopic tolerances. VTR equipment falls easily out of alignment. An accidental blow to the recorder, for example, is capable of putting it immediately out of operation. For this reason, VTR units are notorious for their "downtime" -- the time when they cannot be used because they are being repaired or adjusted by a professional technician.

Any manual will caution against operating video equipment under conditions of high humidity and dust. In an environment of severe humidity, moisture can condense on the head drum and cause the tape to adhere to it, to the point of completely stopping the machine. Dust will rapidly foul the video heads and dust and dirt that accumulate along the tape path can seriously affect head tracking, and thus interchangeability. High humidity will also adversely affect the electrical resistances of the components and thus their proper functioning.

VTR equipment will operate reliably only under conditions of cleanliness and moderate relative humidity and temperature -- such as may be obtained in an air-conditioned and dehumidified studio or work area. Beyond these requirements, the most important operational procedure is to ensure the cleanliness of the machine before use, and to clean it again after use. A single speck of dust in the wrong place can cause a continual "dropout" -- a no-record -- all along the tape. The cleaning of the recorder's head, guides and drum, which requires special fluids, should be given great care and attention. Also, only good quality video tape should be used, since the video heads rotate at a very high rate of speed and physically contact the moving tape. These heads, however, are brittle and will be damaged easily, particularly if they come in contact with any hard articles. Replacement cost for video heads for ½-inch VTR's is between $150 and $250.

Other operational precautions are as follows:

- Do not block the ventilation grills on the bottom of the VTR or it will overheat.
- Keep the VTR clean and free of dust at all times.
- Keep the cover on the VTR when not in use.
- Clean the VTR before each use.
- Avoid subjecting the VTR to mechanical shock or vibration.
- Make sure the function lever is in STOP mode when not in use.
- Use the same size reels for supply and take-up.
- Remove tape and reels during transit.
- Do not operate the VTR in extreme temperature environments.
- Clean the head drum immediately if it is exposed to salt air.
- Have the VTR checked twice a year for proper tracking, tension and sync specifications.
- Do not force anything when operating the VTR; if you have to force it, you are doing something wrong.

CARE AND HANDLING OF THE VTR: THE MONITOR.

VTR monitors look like, act like and should be maintained like any other television. The effects of humidity are the same as on any other electronic hardware. Humidity condensation can cause shorts, and absorption of moisture can change electrical characteristics in some components. In addition, excessive humidity coupled with high temperatures can lead to oxidation of structural parts, weakening them. Overheating can cause the capacitors to break down, and some oils tend to evaporate in such conditions, leaving a sticky residue which attracts dirt and dust. Even under conditions of normal use, the heat given off by the monitor while in operation will attract dust from the air back into it. This dust can cause short circuits and switch failures. For this reason, operation in dusty environments should be kept to a minimum.

As with any television, monitors shouldn't be handled roughly or subjected to undue vibration.

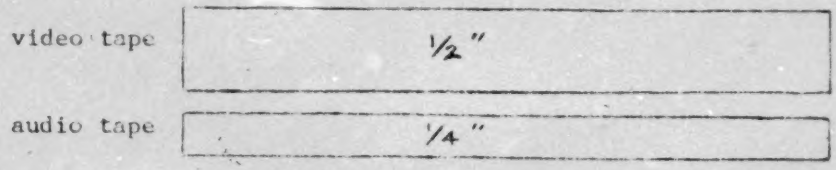
CARE AND HANDLING OF THE VTR: CABLES.

The cables connect the VTR components together -- camera to recorder to monitor. All the information travels through them and therefore care must be taken with them. Broken or dirty connections are sometimes difficult to detect. The wires inside the cables are closely fitted and rough handling can render them useless. Briefly:

- Keep connections clean and free of dirt.
- To each unit attach a list of all cables which belong to that unit, or color-code them. Keep a list of all pieces of equipment in order to prevent loss.
- Keep a supply of spare extension cables for power, microphone and video camera.
- Keep a stock of adaptors for audio connections.
- Do not break a prong -- equipment will not work.
- Do not bend cables excessively -- this will weaken them and tear wires from the plug.
- Do not drop the plug on the floor -- this will weaken or break it.
- Do not lose any cables, as replacement is expensive and/or difficult.
- Avoid high temperatures and humidity.

CARE AND HANDLING OF THE VTR: MAGNETIC RECORDING TAPE.

VTR tape resembles audio recording tape, though it is larger. Since all the information is stored on the tape, care should be exercised in handling it.



The most common forms of damage to video recording tape are scratching, cinching and edge damage. These may be caused by the reel, the tape deck, or the operator.

The reel.

Discard broken, bent or distorted reels. A broken or badly distorted reel can quickly and irrevocably damage a tape. Broken or cracked flanges will cause a series of nicks or mutilated area along one edge. A bent reel will also cause damage if the tape is allowed to rub against the flange while being used. Edge damage means that the edge track will be lost. But also, debris generated from edge damage can be redeposited onto the tape, which can also cause an accumulation of backing oxide debris.

Lift the reel from its box or the VTR by its hub, or one (only one) of the flanges. The two flanges should never be squeezed together.

Do not drop or bump a reel of tape. 1-inch tapes are heavy. Flange damage can easily occur, or cinching of a loose pack. ½-inch tapes are in plastic reels that can be cracked or chipped if dropped.

Bring a reel of tape to room temperature before use if it has been stored in abnormally low or high temperatures. A good rule of thumb is one hour for every 10 degrees of difference. This will ensure good interchange between VTR's.

The deck.

The same size reels for supply and take-up should be used.

Wrinkled or damaged tape ends on the VTR tape should be cut off. Threading wrinkled tape may result in mis-alignment of tape and subsequent damage to the rest of the reel and the VTR head.

Edge damage will occur if any of the deck components is misaligned.

Periodically inspect stationery VTR components (guides, heads, capstans) for damage, excessive wear, or contamination. Scratches and edge damage are normally the result of one of these items and can create a negative cycle of debris generation and re-contamination.

The VTR should be cleaned before threading new tape on it. Only special solution recommended by the manufacturer should be used. The deck should be inspected after each roll has been run.

Since video tape is very thin, utmost care should be taken to thread it properly before the VTR is turned on.

Allow reels to come to a normal stop before changing tape speed or direction. Abnormally rapid stopping or directional changes can cause cinches, and poor packing, especially if the brakes on the reels do not operate evenly.

Never remove tape from the VTR in the middle of a reel as edge damage or surface damage may result.

To avoid damage caused by exposed tape layers in a scattered wind, always run the tape to the end of the reel and completely rewind the entire reel after a partial run if edges are exposed. A scattered wind is caused by variations in tensions when going through start, stop and directional changes.

The operator.

The operator should never touch the tape with his fingers. Body oils and salts act as a magnet on the tape, attracting debris. Fingerprints on the backing are just as serious as on the coating because dirt deposits will transfer from the backing of one wind to the coating of the next wind on the reel. When a reel is contaminated in this manner and is then put into use, the deck itself can pick up debris and spread it to other clean reels. This is one reason for frequent cleaning of tapes, reels and deck.

No food or smoking should be allowed in the work area as both minute food particles and ashes can contaminate tape and deck.

DROPOUTS

If a piece of the magnetic oxide, or coating, flakes off the tape or is roughened, it will cause the video heads to skip over the tape instead of contacting it firmly. When the coating flakes off, the tape loses its ability to ever contain information at that point. The result is a line of missing information in the picture when viewed on the monitor. Once a dropout occurs it cannot be replaced or corrected physically. However, there are more sophisticated VTR's which feature electronic dropout compensators. These machines are capable of sensing the dropout while it occurs. The missing line of information is replaced with a good line, thus eliminating the appearance of a dropout on the monitor.

Dropouts are common at the beginning and end of a reel of tape, and so recording here is not recommended. Also, a certain amount of dropouts is considered normal. Sony claims it is normal to expect up to 25 dropouts per minute throughout the reel. Dropouts will accumulate with time, use and abuse. But if they become really common and annoying, the tape should be discarded or used for expendable programs. Constant dropouts (two to three per second) could cause loss of sync and picture stability.

CASSETTE SYSTEMS.

The concept of the video cassette system can be appreciated if one compares the ease of handling and operating a cassette recorder and a reel to reel recorder. There are certain drawbacks, however, one of these being the cost (see Appendix for cost figures). Cassettee recorders are also more complex in their construction and could lead to maintenance problems and more stringent maintenance requirements.

STANDARDIZATION AND COMPATIBILITY.

Because there were so may companies manufacturing video equipment, there developed a need for standardization. In 1969, the Japanese manufacturers, who produced the majority of VTR units, established the EIAJ standards for all ½-inch reel to reel VTR's produced after that date. EIAJ stands for Electronics Industries Association of Japan.

Though all ½-inch VTR's are now manufactured to standardized specifications, the problem of compatibility nonetheless arises. In principle all VTR units of the same format should be compatible; that is, a tape made on one ½-inch unit should be able to be played back on another ½-inch unit. Often, however, because of minute differences, the results are not satisfactory. These differences, are such things as variations in tape tension and head drum surface coatings. Of course, any improper variations from EIAJ standards will immediately eliminate any possibility of interchangeability.

The best way to ensure interchangeability is to purchase, at the outset, similar make units. Also, twice a year tape alignment (tracking) should be checked against a factory standard tape available from the manufacturer, and once a year the machine should be aligned to the manufacturer's specifications. Of course it will help to keep the recorder heads and guides perfectly clean.

STORAGE AND PROTECTION OF MAGNETIC RECORDING TAPE.

The temperature and humidity of the storage area should be about the same as for the work area. The smaller the environmental change experienced by the tape, the better will be its performance and reliability. In general, a temperature between 60° and 80° F. and a relative humidity between 40% and 60% is recommended. In Bangladesh, this will necessitate the use of air conditioners and dehumidifiers. If the conditions of the working area vary widely from the storage area, time should be allowed for the tape to reach temperature and humidity equilibrium before it is used. Frequent temperature changes can be damaging to tape, due to expansion and contraction stresses.

Tapes should never be allowed to sit in direct sunlight, or be subjected to high temperatures. The plastic molded cases used for cartridges and cassettes can be distorted, the splices in the tape rolls may separate or the splicing adhesive may soften and ooze from the edges, sticking to adjacent tape layers. The adhesive will also attract dust and lint, causing additional problems.

When not in use, the VTR tapes should be returned to the storage area. Tape should be returned to its storage box and stored on edge, rather than flat. This will keep the tape clean and prevent it from shifting against the flanges, causing edge damage. For long-term storage, additional protection can be gained by sealing the tape container in a plastic bag. The storage container should of course be cleaned before it is used.

It is also very important to prepare tapes for storage by winding them correctly. A relatively low wind tension is recommended. Edges should be smooth, with no protruding individual layers (scattered wind) which may be easily damaged. The wind should be neither too tight (which may cause distortion of the tape, especially if subjected afterwards to high temperatures), nor too loose (as slippage or cinching may occur, causing wrinkles or folds in the tape). For best long-term storage, tape tension should be normalized by complete rewinding end to end. This will reduce the possibility of long-term base film 'creep' due to differential stress.

A good practice, too, is to select a random sample from various areas of the tape library for inspection. Reels should be examined for loose winds and dust accumulation. They should also be checked for rippled edges or other signs of distortion. If anything is found, additional reels should be inspected to ascertain what percentage of the library may be affected.

VIDEO TAPE EDITING.

Audio tapes and film can simply be cut and spliced. But video tapes cannot. Mechanical editing of helical-scan video tape is not only impractical, but annoying visually. Since the TV pictures occupy a position on the tape which slants at a 10° angle, simply making a vertical splice in the tape will cause the picture transition to be a swipe across the monitor screen lasting as long as four seconds.

Moreover, mechanical tape splicing may also cause severe head clogs and even damage due to the force with which the video head strikes the edge of the tape.

The only satisfactory way to edit video tape is by dubbing, or transferring the images from one tape to another in the sequence desired. This means that the edited tape will be a second-generation assembled copy of the original master tapes. (In film terms this may be compared to A&B roll printing.)

This process of dubbing of course requires at least two VTR's, one to hold the original tape, and one to hold the tape onto which the edited copy is being made. This means that the simplest form of video editing requires the expenditure of another $1000 or more for the second deck. Furthermore, the process of dubbing is time-consuming because sequences of tape must be run through in "real time." It takes a full three minutes, for example, to dub a three-minute sequence onto a second tape. (By way of contrast, film editing does not involve dubbing or "real time". The film itself is simply cut and spliced at the desired points in the sequence of pictures.)

It is important that all VTR equipment be to standard EIAJ specifications and compatible in tracking with each other. Compatibility may be achieved by initially purchasing all the equipment from the same manufacturer. The machines must also be maintained well and periodically checked for proper alignment by a professional technician.

THE RECORDING AREA.

The area in which VTR equipment will be used should approach as nearly as possible a "clean room environment." By definition, this means the absence of normally tolerated levels of airborne dust and lint. The design of the facility should also allow for control of temperature and humidity. This is particularly important in Bangladesh, and would require the installation of air conditioners and dehumidifiers. The average temperature should be maintained in the 70's, and the relative humidity at about 50%.

The integrity of the equipment area should be maintained by regular cleaning. However, if vacuum equipment is used, its exhaust should be located outside the room. There should be no fans in the room, to blow dust and dirt about. Neither should there be any rugs on the floors, as they only serve to trap dust and dirt.

Aside from the benefits to be gained from a well-maintained and controlled working environment, the psychological effect upon the employees is very important. It is found that operators will exercise greater care and are inclined to be more concerned with the quality of their work in a clean environment.

AN ABBREVIATED COMPARISON

VIDEO TAPE RECORDING	FILM
Light energy is transformed into electrical energy.	The image is registered on light-sensitive film.
Electrical energy is stored on magnetic tape; may be erased and re-recorded.	Film is developed by a chemical process which fixes the image permanently on the film.
For playback, magnetic energy is converted to electrical energy which upon striking the TV screen is tranformed into light energy.	Reproduction is accomplished by projecting light through the fixed image on the film.
The sync band keeps the sound and visual together, keeps the tape moving at a set speed.	Sprocket holes in the film keep it moving at set intervals, keep the sound and image synchronized.

FILM

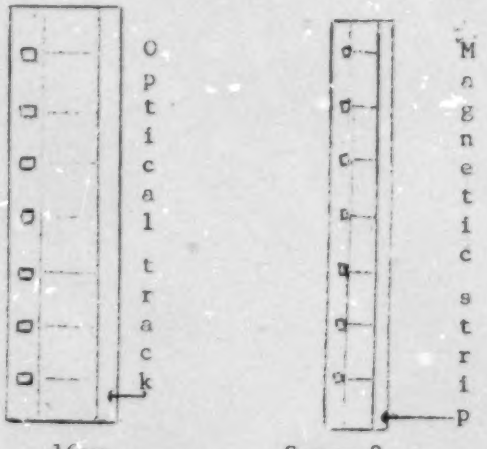
The movie camera records an image by transmitting light through a lens onto light-sensitive material. This material (film) is pulled through the camera in back of the lens at set intervals, or at a set speed. The image which has been recorded on the film may only become visible after undergoing a chemical conversion in which the image is fixed permanently onto the film in one of two ways: as a negative, or as a reversal print, which is basically the same as a slide.

What we see projected on the movie screen is really only an illusion of movement. It is a series of still photographs taken at such close intervals in time that when they are projected rapidly one after the other, our eye records continual movement -- it fills in the gaps, so to speak. The principle is the same as for a child's flip-book or the old fashioned moviola.

The projector works by pulling the developed film at a set speed between the projection lens and an intense light source. At the instant the light-struck film passes in front of the lens, the image is projected onto the screen.

The quality of the image projected depends on the quality of the camera lens, the degree of sensitivity of the film used, and the transport mechanisms in both the camera and the projector.

16mm film has transport, or sprocket holes on one or both sides of the picture, whereas Super 8 will always have only one row of perforations. Synchronized sound may be added to the film either optically or magnetically. In the latter case, a stripe or thin band of magnetic tape is added alongside the images the whole length of the film. Optical sound is a photoelectric process in which a band of light modulations on the edge of the film is converted into electrical signals.



MOVIE CAMERAS.

16mm cameras come in a profusion of makes and models. Prices range from approximately $700 for a Bell & Howell 70Dr spring-drive camera to $10,200 for an Arriflex camera with lens. Basically, they all do the same thing -- pull the film before the lens to be exposed. But there the similarity ends. For a price one can purchase cameras equipped with various motors for sync speeds, high speed or slow motion photography. Cameras can also be equipped to do specialized jobs such as film underwater or through a microscope.

Super 8 cameras also come in a variety of prices and models, from the Kodak Ektasound 130, which can record sound directly onto the film, at under $200, to the super sophisticated Beaulieu 5008S at $1448, which can record sound on the film, has variable speeds, macrocinematography capabilities, and may other features which can be enlarged upon to meet any needs. In between these two are sophisticated Super 8 cameras that can offer professional capabilities in the price range of $600 to $800.

No matter what the camera or its price, the same maintenance precautions apply to both 16mm and Super 8.

CARE AND HANDLING OF THE CAMERA.

High humidity which encourages corrosion and fungus growth has a harmful effect on most materials used in cameras and carrying cases. Metal parts will rust and mould will attack leather parts, stitches in straps and cases, fabrics and even the glass surfaces of lenses. Aside from humidity and heat, cameras and lenses (and VTR cameras) must also be protected from fine dust, silt or sand which will penetrate through any openings, no matter how small. One way to protect equipment is to cover any cracks or openings, where practical, with adhesive tape. Dirt often lodges in the aperture of the camera, and then shows up on the screen when the film is projected. This should be cleaned after every roll of film. At this time the pressure plate should be cleaned, too. In this respect Super 8 cameras, particularly rear-loading models, are especially difficult to clean.

The singularly most important preventive measure with any camera is to keep it clean. One should make a habit of examining the camera thoroughly after each day's use for film chips, emulsion deposits, dirt, dust and sand. The camera should be kept as dry as possible. If it does get wet, it should be kept wiped off immediately. Then a solution of oil with a little solvent, such as benzene, should be applied with a lint-free cloth in very sparing amounts. Afterwards, the camera should again be wiped down with another lint-free cloth. No solution should be used inside the camera, however. If there is moisture inside the camera, it should be wiped away with a dry cloth.

Attention should also be paid to the carrying and storage cases, which should be of the type especially constructed for protecting camera equipment from excessive vibration, heat, dust and moisture. They are usually aluminium to reflect the heat, and are hermetically sealed. They should be constructed to give optimum sturdiness and durability.

When not in use, cameras should be stored in "dry chambers," that is to say, a room which is air-conditioned and dehumidified. If this is not practical, a "hot cabinet" or electric dehumidifier should be used. If none of the above are possible, then ½-pound of silica gel in a well-gasketed 55-gallon drum would provide adequate protection from humidity. However, the silica gel will be rapidly exhausted if the drum is opened too frequently, allowing the humid atmosphere without to enter the drum. One test to ascertain if the desiccant is still working is to notice, upon first inserting one's hand into the drum, a certain coolness due to the rapid evaporation of normal skin moisture. The sensation is only momentary, but noticeable; otherwise the silica gel needs reactivating.

Camera equipment should be overhauled and cleaned before being brought to a tropical country such as Bangladesh. The authorized repair facility should be apprised of the climatic conditions here before they undertake the work. If the equipment is to be inactive for long periods of time, it should be hermetically sealed in cans or metal foil bags. If sealed with an adequate amount of desiccant, the equipment should be protected indefinitely. Too much desiccant should not be used, as it will have a tendency to dry out the lubricating oils in certain kinds of equipment. As these oils evaporate, they leave a gummy residue which could prevent the proper functioning of the equipment.

If the equipment will be used frequently, then a "hot cabinet" should be constructed, or a dehumidifier installed, as mentioned above. A "hot cabinet" is equipped with a light bulb or resistance heating element inside it, at the bottom. The temperature should be adjusted so that it remains 10° above the prevailing atmospheric temperature. Air holes at the top and bottom let the hot air escape, and along with it drive out the humidity.

The use of a dehumidifier necessitates sealing off a small room. All leather cases and coverings should be removed from the equipment to be stored, as they tend to hold moisture.

When none of the above conditions are available during short, operational periods of time, frequent "airing out" of the camera is recommended. This means that the camera is opened and for a short while, the sunlight is allowed to dry out some of the moisture.

With proper care and preventive maintenance, film equipment can be readily utilized in an area such as Bangladesh with a minimum of problems. However, cameras utilizing complex electronic circuitry should be avoided if possible since humidity will affect the electronic components and could cause future difficulties in repair and maintenance.

CARE AND HANDLING OF LENSES.

The lens is the most delicate part of the camera, and particular care should be taken that it is not banged or subjected to prolonged vibration. It should also be guarded against extremes of temperature. If the camera becomes very hot (if, for instance, it is left in the sun), not only will the film inside it be spoiled, but the lens cement may also soften. Subsequent mechanical

strain produced by jarring or rapid cooling may cause "starring" of the lens cement. The elements may be loosened, or cracked. This kind of damage may only be repaired by the lens manufacturer. Zoom lenses are particularly fragile and should be removed from the camera body while the camera is being transported.

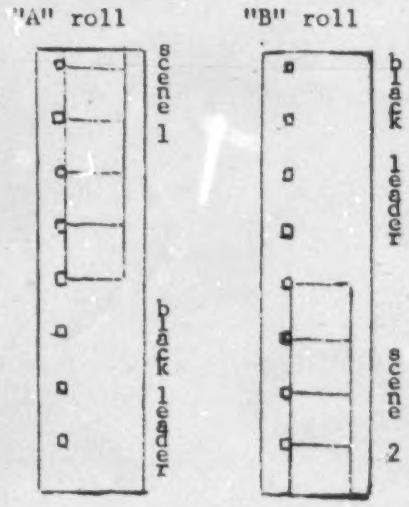
It is a good idea to always keep a UV filter, or clean optical glass filter on the lens to protect it from sand, wind and spray. This will also protect the lens from fingerprints and dust. When the lens is removed from the camera body, a rear cap should be used. The lens mount and socket should be protected also against dirt by a cap, if the lens is off the camera for any length of time.

Dust or dirt should be removed from the lens by a rubber syringe, or anything that will shoot a jet of air onto the lens. If the lens is tilted down, the dust will fall off. One should not blow onto the lens, as saliva will get onto it. A camel's hair brush may also be used to clean the lens, but it should not be handled in any way so that oil from the hands does not contaminate it. Lens cleaning paper should not be used, as it will only grind dirt into the lens, scratching it. Fingerprints and oil should be removed right away, as the longer they stay, the harder they are to remove, and being acidic, may cause permanent damage. For this, lens paper may be used, but not on a dry lens. Lens cleaning solution should be used, though it shouldn't touch where the element is attached to the lens barrel as it may loosen the adhesive bond. If solution isn't available, one may breathe (not blow) onto the lens to get a condensation on it, then rub gently with lens paper, always using a clean portion of the paper for each wipe so that dirt picked up on the paper won't be rubbed back into the lens. At no time should eye-glass cleaning paper which is silicon-coated be used on camera lenses, as this can permanently damage the lens.

FILM EDITING.

Editing is the process of cutting the film and arranging the scenes so that they convey what you intend them to in the most effective possible way. Editing gives the film its mood and pacing. Putting a movie together can be accomplished by simply splicing the scenes directly together at the desired point. A good splicer and lots of time is all one needs. The end result will show the splices on the screen, however. The method is simple, but the quality suffers in the viewing.

For a more professional effect, a spliceless print is necessary. This means the film will have to be edited onto A & B rolls, a process also known as "checker-board" editing. Scenes are alternately spliced onto reel A and reel B. On reel A, after scene 1, there will be a piece of black leader corresponding to the length of scene 2 on roll B. Then on reel B, after scene 2, there will be a piece of black leader corresponding to the length of scene 3 on roll A. The end result is that your film is on two separate rolls, each exactly the same length, but each with only half the scenes of the movie. The two rolls are then sent to the laboratory where an entirely new copy a combination of the A & B rolls, will be made. First the A roll is copied. Where there is only black leader no picture will be copied, of course. After roll A is printed up, this copy is wound back to the beginning and roll B is copied onto the same film as A was. In those spaces between the scenes of roll A, the scenes of roll B will be printed. The result is a copy of the entire film without any splices -- a spliceless print.



All this editing can be done on a movie editor which is a small viewing screen with supply and take-up reels mounted on either side of it, and a frame counter. The film is wound by hand through the viewer, stopped and cut at whatever frame a splice is desired. Editors can cost from $100 up. Editing equipment must be kept in the same kind of condition as cameras and projectors. They are subject to the same problems due to humidity, dust and heat. Cleanliness is very important since dirty editing equipment could damage and scratch the film. Once a scratch is put into the film, it will remain for all subsequent copies made.

Editing a film with sound is a little more complex since the sound and image must be in synchronization. Adding sound, or editing sound, is done in several ways.

SOUND EDITING - WILD SOUND.

One method of adding sound to a film is to record a narration onto a magnetic stripe which is put onto the film after it has been edited. This magnetic stripe is in reality a thin piece of audio tape applied along the entire length of the film next to the picture frames. Like audio tape, it can be erased and re-recorded. Some projectors, such as the Kalart/Victor Model 82-25, are capable of recording sound onto the magnetic sound stripe.

Another system for 16mm films is the Sonorex 16/16 Interlock Projector distributed by Arriflex. In this system the sound and visual are separate but interlocked. The sound is recorded on 16mm magnetic tape. The projector becomes a mechanically interlocking magnetic tape deck that can run both 16mm movie film and sound tape in perfect synchronization for previews, sound transfers and recording. After the sound is synchronized as desired, it can be sent out to a lab to have an optical track made which would be transferred onto a copy of your film. This entails the expense of another print. Or, since the projector is capable of running both film and sound track in perfect sync, the two could be left separate. A certain amount of flexibility can be gained in this way since the same film can be used several times with different narrations to describe different operations in the same film.

SOUND EDITING - LIP SYNC.

Thus far we have been discussing what is known as "wild sound." Though the sound is in synchronization with the scene to which it applies, it is not in "lip sync." In order to achieve lip sync the camera must run at a constant 24 frames per second along with a specially designed tape recorder. The camera has to have a governor motor which puts out a sync signal to the recorder equipped with a sync track generator. Cameras capable of shooting synchronized sound fall into two groups. In the first group are the inexpensive cameras (about $2000). These are light and portable, but a little noisy. The Bolex H16 Rex 5, and the 16mm Beaulieu are examples. These cameras take 100-foot spools, though Bolex has a 400-foot magazine and the Beaulieu can be equipped with a 200-foot magazine. Into the second group fall the more expensive cameras (starting at $4000 or $5000). These are heavier cameras (about 14 lbs. or more). They are virtually noiseless when running. They all accept 400-foot magazines. Examples are the Arriflex, Eclair and Blex Pro. With a properly equipped recorder, all will record in lip sync. Most of the more expensive Super 8 cameras, such as Nizo or Beaulieu, are equipped with sync generators, and along with the proper recorder will give the same results as the above mentioned 16mm cameras.

Once the lip sync'd sound track has been recorded, it must then be transferred to magnetic tape. This tape is the same size as the film and has sprocket holes as well. To keep the sound and film to be edited in the same relationship with each other, a synchronizer is used. It consists of 2 or more sprocketed wheels mounted on a revolving shaft. The picture goes on one wheel and the sound on the other. Because the sprocket holes of the film and the magnetic tape are engaged on the sprocketed wheels of the synchronizer, the two stay in relationship with each other as you go about the process of editing. There are editing tables that do the same thing, equipped with motors that run at 24 fps, so that you can see and hear at the same time. Known as Moviola, these tables cost about $3000, and must be carefully kept in adjustment as they can tear the film and put undue stress on the sprocket holes. There are also flatbed tables such as the Steanbeck, but these are much more expensive.

After the film is edited and the sound matched as desired, the magnetic sound tape is sent to a lab to have an optical track made. The optical track, which will be printed as a part of the final copy of the film, works on the principle of photoelectric cell density variations. The amount of light passed through the optical track is transformed into electrical impulses and then into sound.

FILM - CAUSES OF DAMAGE.

The two worst enemies of film emulsions, especially color, are heat and humidity. Film is not an inert substance. It constantly takes in or gives off moisture until it reaches equilibrium with its surrounding atmosphere. For this reason, film reacts to heat and humidity by swelling, while the emulsion softens and becomes tacky. Adjacent layers of film may stick together. In the camera the film may drag under the pressure plate, stripping off the emulsion. Or it may refuse altogether to pass through the camera mechanism. Heat and humidity also encourage the growth of mould or fungus on the film. Fungus may even grow on the film if it is left in the camera for a long period of time in an atmosphere of high relative humidity. In most cases, fungus growth on the emulsion side of the film will cause the gelatime to become soluble in water, making the latent image vulnerable to being permanently destroyed. If the emulsion becomes etched or distorted by fungus growth, or if spots form on it, there is no satisfactory method of restoration.

Kodak suggests that film if kept in its original humidity-proof container may last as long as 6 months at a constant temperature of 90° F. However, at 100°, the life of most sensitized materials is measured in weeks. Once film is exposed to humidity as well as heat, deterioration is rapid. Exposed to a constant temperature of 95° and a relative humidity of 90% (common in tropical countries such as Bangladesh during the rainy season), film may become unusable in a matter of days.

It should be understood, however, that all photographic materials change in time. Color dyes are the least stable and fade. In general, the older the film, the less sensitive to light it becomes. In black-and-white, there may be an increase in graininess; in color, there may be a shift in color reproduction.

Damage to film may also result from any one of the following: improper handling resulting in fingerprints, wrinkling or crimping; breakage or contamination during projection due to dirt in the projector, improper threading, or improper operation of the projector, or poor splicing of the film; improper rewinding of the film causing cinching; overloading the reels causing edge damage; lack of inspection and repair of film before projection; and improper storage.

FILM - PRECAUTIONS AND CARE.

Raw stock should be as fresh as possible, as all photographic materials can be expected to change with time, even unexposed film. If possible, film should be purchased in special tropical containers: the film is wrapped in heavy tinfoil, placed in a metal container which is itself wrapped and placed in another container along with desiccant. If opened, the container should be closed again in a dry atmosphere, or with a desiccating agent. Expiration dates on film should be checked. 400-foot rolls should be purchased from a reliable manufacturer since they usually don't have expiration dates. It is also a good idea to purchase photographic supplies in small containers and quantities, so that the entire contents may be quickly used upon opening. Especially in tropical climates, film should be processed immediately after it has been exposed. If this is not possible, it should be stored in a refrigerator to retard deterioration of the latent image, in particular color film.

The areas where film will be handled, or stored, should be clean and free of dust and dirt. Ideally, they should be air-conditioned, filtered and dehumidified. Film is best handled at 65° or 70° F. and at a relative humidity of about 50%, because it is then pliable, easy to work with, clean and inspect. At all times, film should be protected from rapid temperature changes. If film

is sealed in a humid atmosphere and then rapidly cooled, moisture droplets can form and damage the emulsion surface. Also, when film is being removed from storage in a cool atmosphere for printing or projection, it should be allowed to rest for several hours at room temperature and humidity.

Certain precautions in the preparation and projection of film will increase its life and usefulness:

- The projector gate and other parts that guide the film through the projector should be kept clean.
- Film should be threaded correctly.
- Film should be inspected and repaired when necessary before projection.
- Fingerprints on film should be avoided. Film should be handled by the edges only.
- Film should be cleaned and lubricated.
- A long leader and a trailer should be attached at the beginning and end of each reel to protect the film from damage when starting and rewinding. Leader and trailer are easy to replace when damaged.
- Reels should not br filled to capacity, but only to within ½ inch of the flange edges. Film from an overloaded reel can be easily damaged, or may not be taken up properly in the projector.

Films which may be projected several times a day present a special problem. If the loosely wrapped turns of film are exposed to high humidity, the consequent swelling of the emulsion layer may cause the film to distort or become kinky; the film may become tacky and stick in the projector gate. The use of desiccants in the film cans will reduce the trouble, but may be inconvenient under conditions of constant use. If such is the case, another method is to seal the film up in a can with two turns of adhesive tape while it is still warm from the projector. Another method would be to store the reel in a large box with ample air space, the temperature of which would be maintained at 10 degrees above atmospheric conditions by an electric bulb or heater. This reduces the relative humidity of the air in contact with the reel, but it is not a suitable method for longer periods of storage.

If fungus growth occurs on film, it may be cleaned with a non-aqueous solvent (since fungus causes the gelatine to become soluble in water). The affected areas should be wiped gently with a clean, soft pad or chamois leather impregnated with cleaning fluid. Kodak produces a film cleaner combined with lubricant. However, once film emulsion has become etched or distorted by fungus growth, the damage is irrevocable. But if the film is laquer-coated after cleaning, the etching effect will be minimized and some protection against future damage will be provided.

One of the most important precautions in preserving processed film is its inspection at suitable intervals. Each roll should be carefully examined on the outside and at the end. If there is any suspicion about its condition, the rolls should be examined throughout. In this way any incipient damage can usually be caught before it has gone too far. In severe climatic conditions where humidity is not controlled, inspection should be every three months. Where temperature and humidity never exceed the recommended limits, inspection may be every two years.

FILM SPLICES.

Film breaks and when it does care must be taken in its repair since poorly made joints can stick in the projector and become accumulation points for dirt, causing scratches on the film.

Splices may be joined by special tape or by cement. However, in a tropical climate, neither of these methods would be as long-lasting or sure as a hot-splice, in which the join is made with the aid of heat -- something like welding. Hot splicers are the most expensive type manufactured, costing as much as many high-quality Super 8 cameras. But in the long run, in terms of convenience, wear and tear on film and projector, a very worthwhile investment.

FILM STORAGE.

Film storage requires temperatures as low as 40° to 50° F. with a relative humidity of about 40%. This is especially true for color films. It must be remembered that heat and humidity are the two great enemies of film. Humidity, however, is the most damaging. Color films may be expected to have a useful life of many years if handled with care, shown properly in good projectors, and stored at 70° F. with a relative humidity of 50%. But if humidity exceeds 60% for any length of time, fungus growth may become a problem. Temperature and humidity control is especially critical for exposed color film. Dehumidification of the storage and handling areas is recommended.

In the storage area, cans of film should be kept lying flat to prevent distortion from the sagging of any loosely-wound rolls. They should be stacked no more than 6 or 8 high.

TEMPERATURE AND HUMIDITY RECOMMENDATIONS*

	Long term storage		Films in Active Use	
	Temp.	R.H.	Temp.	R.H.
Black-and-white	Below 80°	40-50%	Below 80°	25-60%
Color	50° or lower	25-40%	Below 80°	25-60%

There are various methods for controlling temperature and humidity. They are arranged, as follows, in order of decreasing cost and convenience.

(1) Air conditioning. Air conditioning with effective relative humidity control is the most desirable method, but also the most expensive.

(2) Dehumidification. Where complete air conditioning is not possible, the next best thing is to install a dehumidifier in a small room. The room should be as air-tight as possible, the walls being sealed with a coating of asphalt paint, aluminium paint, or paper-laminated aluminium foil, if available. Doors and windows should be weather-stripped. Such a system, however, will provide no cooling of the air.

(3) Sealed cans. This method requires that each roll of film be conditioned to the proper relative humidity before it is packed into air-tight containers. Therefore, some type of conditioning cabinet is necessary, together with some laboratory control. The film, once conditioned, is sealed in a suitable can with two turns of rubber-base adhesive tape.

*From A Guide to Film Making, by Edward Pincus. 1969

This method presents some disadvantages: the conditioning of the film itself is difficult. The film must be reconditioned every time it is used, before being returned to storage. This makes inspection more difficult and time consuming. And, finally, adhesive tapes must be replaced before their moisture protection is lost.

(4) Silica gel. Film may be kept dry by means of desiccation with activated silica gel. This takes one to two weeks for 16mm film, and two to four weeks for 35mm film, depending on the type of spool, tightness of winding, amount of moisture, ratio of silica gel to film and other factors.

Desiccation has the same disadvantages as mentioned in section 3, above. Also, great care must be taken in this process not to over-dry the film so that it becomes brittle.

In tropical climates, all film operations require greater care. Lacquering, frequent cleaning and inspection are much more important than in moderate climates. Film, prints and negatives should be regularly inspected for signs of damage or deterioration. Adverse conditions for only a brief period may have a permanent effect, and these ill effects are cumulative, resulting in damage which cannot be corrected. Inspection and systematic stock rotation are some of the best ways of minimizing the possibility of cumulative deterioration.

APPENDIX A

A NOTE ON EXPENSES AND ESTIMATED COSTS.

It should be kept in mind that the following estimates on VTR and film systems do not include maintenance and upkeep expenses. One may figure that approximately 20% of the equipment budget should be allotted for maintenance. Video equipment, to perform reliably, needs a controlled environment, necessitating air conditioners and dehumidifiers. If these are not already available, they must also be figured into the costs of setting up a video system.

In Bangladesh, video equipment will also have to match the existing power supply. This may necessitate a converter. A voltage regulator would also be necessary as power in Bangladesh is not constant. Unregulated voltage, with its highs and lows would be very detrimental to the electronic system that makes the VTR work. Alterations in electrical values caused by the stresses of fluctuating power supply can disturb the precise alignment of the VTR components.

If not properly maintained, video equipment will fall quickly into disrepair. Video repair is expensive, parts are expensive and sometimes difficult to obtain. From Bangladesh, repair costs would also have to include transport expenses for the machine, if repair is done outside the country, or for parts, if the work is done here.

Video equipment should also be regularly checked for realignment, cleaning, etc. This could entail hiring a full-time professional technician, depending on the amount of equipment being used.

The figures given in the following estimates are rounded off. They are based on current U.S. East Coast prices and do not include freighting or shipping costs. It must also be noted that the prices of media equipment are subject to frequent changes, usually becoming more expensive than originally stated. Often-times, too, in setting up a media system budgets are underestimated simply because of poor planning. Little things such as filters, or splicers, or cases to protect the equipment are left out. If, however, one equips himself at the outset thoroughly and properly, including careful attention to spare parts, there will be less chance of a ballooning budget. Careful planning will insure fewer breakdowns and malfunctions. Careful planning, or the lack of it, may make or break an audio visual program.

All the following estimates are only for the raw materials; there is no provision for personnel, equipment protection, air conditioners, dehumidifiers, or vehicles to move the equipment from site to site. These costs depend on the type of program being instituted and can best be estimated by those responsible in each instance.

It must also be noted that for every "suggested" piece of equipment, there are usually two or three other brands that will perform equally as well. Specific choices should of course be based on specific needs. These decisions can only be made for each program individually. The following cost estimates are meant only to provide a starting point.

VTR: ESTIMATED COSTS FOR BLACK & WHITE PORTABLE SYSTEM.

Sony Video Rover 11 AV 340.AVC3400	$1850.
Battery Charger	110.
Battery spare	40.
17" Black & White Monitor	350.
Carrying case	110.
Cables	100.
Tripod	100.
External Microphone	100.
	$2760.

Editing equipment:

Recorder, Edition Sony AV3650	$1360.
8" Monitor	250.
Special Effects Generator	600.
Cables	100.
Ten 20-minute tapes @ $20	200.
	$2510
TOTAL COST	$5270

Note: One can only show the tapes where there is a monitor. If a program is to be used in several locations, frequently additional monitors and recorder units are recommended, since the transporting of VTR equipment will reduce its longivity and usefulness. It must also be taken into consideration that VTR systems are useful only where the audience is small enough to be able to gather around the monitor. Anyone thinking of instituting programs utilizing VTR must be careful to take all these factors into consideration.

VTR: ESTIMATED COSTS FOR COLOR CASSETTE VIDEO SYSTEM*

Recording:	
1 AC/DC Video Cassette Recorder/Player VO-3800 with - DC Chargeable Battery Pack BP-20A - AC Power Adaptor/Color Pack AC-3000 - AC Power Cord - Monitor Connecting Cable VMC-1M (1.5m)	$ 1500.
1 Portable Trinitron Color Video Camera	2400.
Editing:	
2 Color Video Cassette Recorder/Player VO-2850 @ $2900	5800.
1 Automatic Editing Control RM-400	460.
2 9" Monochrome Receiver/Monitor CVM0960 (60Hz) & CVM-950 (50Hz) @ $135	270.
or, 2 12" Color Receiver/Monitor CVM 1320G @ $470	940.
	$ 6530. B&W or, $ 7200. Color
Playback:	
1 Video Cassette Recorder/Playback VO-1810 (PAL CCIR)	$ 1050.
1 18" Color Receiver/Monitor CVM-1810E (220V 50/60Hz)	560.
	$ 1610.

*From the United Nations Development Support Communication Service, Bangkok, Thailand.

Initial Supply of Materials:

50 KCS-20 Video Cassette Tape	$ 598.
10 KA-1 Cassette Adaptor for KCS-20	17.
5 KA-1C Head Cleaning Tape for U-Matic	31.
15 KC-30 3/4" Video Cassette Tape	220.
15 KC-15 3/4" Video Cassette Tape	175.
15 KC-20 3/4" Video Cassette Tape	190.
10 KC-60 3/4" Video Cassette Tape	213.
	$ 1444.

TOTAL COST, 9"	$13484.
12"	$14154.

FILM: ESTIMATED COSTS FOR LOW-BUDGET SUPER 8 SOUND SYSTEM.

Camera, Kodak Ektasound	$ 400.
Sound Projector, record and Playback, Bolex SP-80	400.
Editor, Minette S8	100.
Splicer (see note) Maier-Hancock 816-S Super 8, 16mm	325.
Aluminium storage & carrying case	75.
Screen	50.
Extension speaker, Bolex, with case	100.
Supplementary supplies (lens cleaner, filters, etc.)	50.
TOTAL	$ 1500.

Note on splicer: The Maier-Hancock hot splicer which welds the film at the break is much stronger and more dependable in the long run than cement splicers. Less expensive models which use adhesive, or cement, are not recommended for use in areas such as Bangladesh. Due to the extreme heat and humidity adhesive splices will stretch and become tacky. The splices subsequently collect debris, break or cause difficulty or damage in the projection equipment.

FILM: ESTIMATED COSTS FOR MIT-LEACOCK SUPER 8 DOUBLE SYSTEM SYNC SOUND.

Camera, blimped Nizo S56, 8:1 manual zoom, automatic light meter, battery driven, built-in shoulder pod and crystal controlled at 24 fps and cartridge loading.

Recorder, modified TC124 Sony Cassette Recorder (NO UMBILICAL CORD TO CAMERA) ECM 21, modified microphone, crystal controlled oscillator tone generator to "B" track, automatic gain control eliminated, switchable bass filter, two light emitting diodes for level control, hi/lo indication and slating button (light and beep sync start control) in contour shaped microphone for single hand operation.

Transfer machine, transfer deck, Tandberg II, with guides modified to handle full coated Super 8 magnetic film. Photo cell and light source added for sync control in playback or rerecord mode. Includes cassette playback for transferring.

Editing deck, four plate horizontal deck with 3½" x 4½" bright field image, 24 fps forward/reverse, fast forward/reverse, instant stop and start, double or single strand inching, separate clutches for tape and film, frame counter, second counter and footage/time rule.

Projector, Bauer T30 with five-bladed shutter for TV or standard use, servo controlled motor, interlock to Tandberg, record/playback magnetic striped film.

COMPLETE COST	$6,675.
Add:	
Splicer	325.
Carrying case	100.
Screen	50.
Supplementary supplies	100.
TOTAL COST	$7,250.

FILM: LOW-BUDGET 16mm SYSTEM.

Camera and lens, Bolex Rex-5 with 16 to 100mm lens	$2,000.
Projector, Kalart/Victor Magnetic/Optical/record playback model 82-25 with extension speaker	1,200.
Recorder, Uher 4000 with batteries and microphone	500.
Aluminium storage and carrying case	250.
Editor, Fed-19 Viewer Editor with counters	575.
Splicer, Maier-Hancock Hot Splicer	325.
Tripod	200.
Complement of filters, cleaning tools, etc.	200.
TOTAL	$5,250.

Note: The above system can be expanded to sync sound by the addition of proper motors and blarneys (sound). What is listed above is the basic starting point which can be built into a complete 16mm system. 16mm equipment, which is much more expensive and has a wider range of capabilities, can be purchased. An example is the Arriflex 16 BL which lists, with lens, from $10,175. The initial investment for such a camera is very large, but the Arriflex has proved itself dependable in every adverse condition geography can conjure up. Its capabilities are as varied and innovative as the technicians who put it to use.

SUPER 8: SAMPLE PRODUCTION COSTS FOR 20-MINUTE MOVIE.

Super 8 sound/color film
20 minutes
Kodak sound-striped film, single system
3:1 shooting to screening ratio
24 frames per second
scene to scene splices

Raw stock, 3:1 shooting, 1200 feet: 24 50-foot cartridges, pre-stiped @ $5.70 each	$ 136.80
Processing for same	70.00
One copy, 20-minute film, 400 feet	70.00
TTOTAL	$ 276.80

Note: The above sample represents the cost for a specialized audio-visual, not intended for mass production. It would have the quality of a good home-movie with a message. The price could be decreased, depending on the ratio of raw stock to usable footage.

The same Super 8 20-minute movie produced to more "professional" standards would cost:

Raw stock, 3:1, 1200 feet, Kodak Ektachrome, 24 cartridges @ $3.45 each	$ 82.00
Processing	70.00
Print work	150.00
Black leader for A&B rolls	25.00
Sound striped	30.00
First print	100.00
First copy	100.00
TOTAL	$ 567.00

Note: The basic production cost will vary with the subject matter and how much lab work is desired.

16mm LOW-BUDGET: SAMPLE PRODUCTION COSTS FOR 20-MINUTE MOVIE.

20-min. 16mm sound/color film using Kodak sound-striped film, single system 3:1 shooting to screening ration 24 frames per second scene to scene splices.

Raw stock, 3:1, 2100 feet @ $10 per 100 ft.	$ 210.
Processing	145.
Magnetic sound striping	40.
One copy, 20-minutes, 700 feet	125.
TOTAL	$ 520.
If optional sound tract is used, add	90.
TOTAL	$ 610.

Note: Costs of course depend on subject matter, and ratio of film shot to film screened. It must be noted that most audio-visual films, again, depending on the complexity of the subject matter, do not need to run 20 minutes. On the average a subject can be treated in 10 minutes.

16mm "PROFESSIONAL": SAMPLE PRODUCTION COSTS FOR 20-MINUTE MOVIE.

20-minute 16mm sound/color film
sync-sound shooting
3:1 shooting to screening ratio
A&B roll assemblage

Raw stock (3:1) 2100 feet @ $10 per 100 ft.	$ 210.
Processing	145.
Work print	275.
Black leader	25.
Sound transfer from ¼" to magnetic	25.
Magnetic tape	20.
Magnetic to optical track transfer	75.
First answer A&B rolls, 700 feet	100.
Lab effects: 4 fade outs/ins @ $2 each, 2 dissolves @ $4 each	16.
TOTAL	$ 891.

Note: The above prices are true assuming all equipment is available and nothing needs to be rented. The prices are U.S. East Coast estimates: they only serve as examples and are not meant to be taken as absolutely factual for budget planning. There are other costs involved in making a film, including personnel, machinery operation and maintenance.

APPENDIX B

A NOTE ON ADDRESSESS OF REPAIR FACILITIES AND EQUIPMENT SUPPLIERS.

As far as repair facilities are concerned, there are no doubt many other addresses available. But to simplify matters, only those addresses recommended by the manufacturers themselves have been included. Many of these facilities undoubtedly also repair other makes of hardware or can be used as sources of information for other facilities in the area.

Under the heading of repair certain difficulties need to be considered, one being the costs and procedures for transporting equipment in and out of Bangladesh. These difficulties may be somewhat allayed by having a supply of spare parts on hand, as most mechanical breakdowns can be anticipated. Electronic failures are more difficult to handle or anticipate, given the complexity, especially, of VTR components and some movie cameras.

The addresses listed under equipment manufacturers are offered as sources of information about specific pieces of equipment produced by the various companies. Many of these companies produce all the components of a VTR or film system, some only cameras. By and large, however, any request directed to the information department of a company will be promptly answered, or forwarded to someone who will be able to supply the information desired.

VTR REPAIR FACILITIES CONVENIENT TO BANGLADESH.

ELECTRONIC ENGINEERS & CONSULTANTS Hotel Purbani International Room 930, Dacca, Bangladesh Tel: 256 825	RCA representative in Bangladesh. Will service makes other than RCA but all spare parts have to be brought in for them.
KATONIX C-15 Greater Kailash-L New Delhi 110048 Tel: 630 215 Cable: KATONIX	Services what it sells and the following: International Video Corp. (U.S.A) Ikegami Tsushinki Co. (Japan) Richmont Hills Lab (Canada) Dynair Electronics (U.S.A.) Interand Corp. (U.S.A.) Sony Corp. (Japan)
SETRON ELECTRONICS PVT LTD Dundee Road, Singapore 3 Tel: 622 344	Authorized Sony repair, servicing.
SUNSHINE CO. LTD. P.O. Box 1462 814-818 Wang Burapa Bangkok, Thailand Tel: 214 186	Authorized Sony repair, servicing.

VTR EQUIPMENT MANUFACTURERS.

AKAI OF AMERICA
2139 East Del Amo Blvd.
Compton, California 90220

AMPEX CORPORATION
401 Broadway
Redwood City, California 94063

CRAIG CORPORATION
912 W. Artesia Blvd.
Compton, California 90220

FAIRCHILD CAMERA & INSTRUMENT
Dumont Electronic Tubes Div.
750 Bloomfield Ave.
Clifton, New Jersey 07015

HITACHI AMERICA
437 Madison Ave.
New York, N.Y. 10034

INTERNATIONAL VIDEO CORP.
67 East Evelyn Ave.
Mountainview, California

PACKARD-BELL ELECTRONICS CORP.
1920 So. Figueroa St.
Los Angeles, California 90007

PANASONIC
200 Park Ave.
New York, N.Y. 10017

PHILLIPS BROADCASTING EQUIPMENT CO.
One Phillips Pkwy.
Montvale, New Jersey 07645

RADIO CORP. OF AMERICA (RCA)
Broadcasting and Communication
Front and Cooper Streets
Camden, New Jersey 08102

SANYO ELECTRONIC CO. INC.
Communication Division
1200 West Walnut Street
Compton, California 90220

SHIBADEN CORP. OF AMERICA
58-25 Brooklyn-Queens Exp. West
Woodside, N.Y. 11377

SONY CORP. OF AMERICA
47-47 Van Dam Street
Long Island City, N.Y. 11101

TELEDYNE CAMERA SYSTEMS
131 No. Fifth Ave.
Arcadia, California 91006

3M COMPANY MINCOM DIV.
3M Center
St. Paul, Minnesota 55119

CAMERA REPAIR FACILITIES CONVENIENT TO BANGLADESH.

BELL & HOWELL Cinerama Private Ltd. Bombay, India	Bell & Howell representative and repair
COMEL Sandhurst Bridge 532 Sardar Vallabhbhai Patel Road Bombay, India	Eclair representative
LATIF PRECISION WORKS 24 Chowringhee Road Calcutta, India Tel; 239 959	Employs a man trained by Bolex. General Camera repair.
P. K. MALKANI 18 Strand House, 1st Floor Opp. Strand Camera Colaba, Bombe 5, India	Authorized Nikon repair. Other Super 8 and 35mm equipment.
MANNERS ENGINEERING LTD. P.O. Box 235 Hong Kong ********** 17th Floor Union House Hong Kong	Employs personnel trained by Arriflex in Germany. Stocks most spare parts. Can do all camera work, except lens damage.
O'CONNERS (PTE) LTD. O'Conner House 98 Pasir Panjung Rd. Singapore 5	Eclair representative
ROBERT V. ROSE G.P.O. Box 899 Hong Kong	Eclair repair. Has most spare parts on hand.
TITHES DENTAL & PHOTO SUPPLY SDN BHD 62 Middle Road Singapore 7, Singapore	Authorized Yashica. Repairs most Super 8 equipment.

16mm EQUIPMENT MANUFACTURERS.

ANGENIEUX CORP. OF AMERICA LTD.
440 Merrick Rd.
Oceanside, N.Y. 11572

ARRIFLEX CORP. OF AMERICA
Box 1050
25-20 Brooklyn-Queens Exp. West
Woodside, N.Y. 11377

BELL & HOWELL
2201 Howard St.
Evanston, Ill. 60202

BOLEX DIV. MAILLARD INC.
1900 Lower Rd.
Linden, New Jersey 07036

CANON U.S.A. INC.
10 Nevada Drive
Lake Success, N.Y. 11040

CINEMA BEAULIEU DIVISION HERVIC CORP.
14225 Ventura Blvd.
Sherman Oaks, California 91403

ECLAIR CORP. OF AMERICA
62 W. 45th Street
New York, N.Y. 10036

FAIRCHILD SYSTEMS, DIV. FAIRCHILD CAMERA & INSTRUMENT CORP.
75 Mall Drive
Commack, N.Y. 11725

SUPER 8 EQUIPMENT MANUFACTURERS.

BOLEX DIV. PAILLARD INC.
1900 Lower Road
Linden, New Jersey 07036

CANON U.S.A. INC.
10 Nevada Drive
Lake Success, N.Y. 11040

CINEMA BEAULIEU DIV. HERVIC CORP.
14225 Ventura Blvd.
Sherman Oaks, California 91403

EASTMAN KODAK CO.
343 State Street
Rochester, N.Y. 14650

ELMO MFG. CO.
32-10 57th Street
Woodside, N.Y. 11377

EUMIG (U.S.A.) INC.
Lake Success Business Park
225 Community Drive
Great Neck, N.Y. 11020

FUJICA U.S.A. INC.
350 Fifth Ave.
New York, N.Y. 10001

GAF CORP.
140 W. 51st Street
New York, N.Y. 10020

HANIMEX U.S.A. INC.
7020 Lawndale
Lincolnwood, Ill. 60645

KEYSTONE (DIV. BERKEY PHOTO)
2 Keystone Place
Paramus, New Jersey 07652

LEITZ E., INC.
Link Drive
Rockleigh, New Jersey 07647

MINOLTA CORP.
101 Williams Drive
Ramsey, New Jersey 07446

NIKON, MARKETED BY EPOI
623 Stewart Ave.
Garden City, N.Y. 11530

NIZO/BRAUN NORTH AMERICA
55 Cambridge Parkway
Cambridge, Mass. 02142

OPTASOUND CORP.
116 John Street
New York, N.Y. 10038

ROLLEI OF AMERICA
100 Lehigh Drive
Fairfield, New Jersey 07006

SANKYO SEIKI (AMERICA) LTD.
149 Fifth Ave.
New York, N.Y. 10010

YASHICA INC.
50-17 Queens Blvd.
Woodside, N.Y. 11377

APPENDIX C

A NOTE ON SOURCES OF INFORMATION.

In this section, the names and addresses of a variety of organizations and companies are offered as sources of information. A list of periodicals is also included which will offer ideas, up-to-date technical information and discussion of the latest trends in audio-visuals.

These lists are by no means complete and should be viewed as a starting point for those seeking further information on the various methods of visual production, care and maintenance of equipment, technical information, program planning and the role of media in education.

USEFUL ADDRESSES.

Agfa-Gevaert India Ltd.
Merchant Chambers
41, New Marine Lines
Bombay 20, India
- Source Bolex equipment

Agfa-Gevaert India Ltd.
34, Mount Road, Madras 2, India

Agfa-Gevaert India Ltd.
2A, Shakespeare Sarani
Calcutta 16, India

Agfa-Gevaert India Ltd.
18A, Najafgarh Road
New Delhi 15, India

Alexander Electronics Inc.
1820 Wyandotte Street
Kansas City, Missouri 64108
-VTR hardware and software.

American Council of Voluntary
Agencies for Foreign Service, Inc.
Technical Assistance Information
Clearing House
200 Park Avenue South
New York, N.Y. 10003
-Technical information.

Audio Visual Consultant Center and
Technical Training Association
Ozaki Bldg.
1-17 Koraku 2-chome
Bunkyo-chu, Tokyo, Japan

The British Medical Association
Department of Audio-Visual
Communication
Tavistock Square
London WC1H 9JP, England

Center for Development of
Instructional Technology
B-10 Jangpura Extension
New Delhi 110014, India

International Scientific Film
Association (ISFA)
Association Internationale du
Cinema Scientifique (AICS)
38 Avenue des Ternes
Paris 17eme, France

Kalart/Victor Corporation
Hultenius Street
Plainville, Conn. 06062
- Manufacturer of projection equipment

Kodak Limited
53 Serajuddoullah Road
P.O. Box 166, Chittagong, Bangladesh

Kodak Limited
Dr. Dadabhai Naoroji Road
P.O. Box 343, Bombay 400 001, India

Information Division
483 Swatantrya Veer Savarkar
Bombay 25, India

Kodak Limited
1133 Avenue of the Americas
New York, N.Y. 10036

Kodak (Singapore) Pte Limited
305 Alexander Road, Singapore 3

Kodak (Thailand) Limited
71 Sub Road, P.O. Box 2496
Bangkok, Thailand

The National Audio-Visual Aids Center
254 Belsize Road, London NW6
England

The National Audio-Visual Association
Incorporated (NAVA)
3150 Spring Street
Fairfax, Virginia 22030

The National Committee for Audio-
Visual Aids in Education (NCAVAE)
33 Queen Anne Street
London W1M OAL, England

The National Educational Closed-
Circuit Television Association(NECCTA)
Paisley College of Technology
High Street, Paisley
Renferwshire, England

National Film Board of Canada
P.O. Box 6100, Montreal, Canada
- Information and assistance on
various aspects of media.

Oxberry, Division of Richmark Camera
615 Timpson Place
Bronx, New York 10455
-Animation tables and copy equipment.

Photophone, Ltd.
7 Saki Vihar Road, Bombay 72, India
-Manufacturer of 16mm projection equipment.

Polaroid Corp.
549 Tech Square Plaza
Cambridge, Mass. 02139

The Scientific Film Association
48 Austen Paths, Stevenage,
Herts, England

Seiki Company Ltd.
25-14 Takinogawa 7-chome
Kita-ku, Tokyo 114, Japan
-Manufacturer of 16mm editing and projection equipment.

Singer Educational Systems
3750 Monroe Avenue
Rochester, New York 14603
-Audio-Visual hardware for education.

The Society of Motion Picture and Television Engineers (SMPTE)
862 Scarsdale Avenue
Scarsdale, N.Y. 10583

Society of Photographic Scientists and Engineers
1330 Massachusetts Ave.,N.W. #204
Washington, D.C. 20005

S.O.S. Photo-Cine Optics, Inc.
315 W. 43rd Street
New York, N.Y. 10036
-Cinema equipment: film, editors,etc.

Superior Bulk Film
442 North Wells Street
Chicago, Ill. 60610
-Film supplies.

Tandberg of America
8 Third Ave.
Pelham, New York 10803
- Tape recorders for sound filming.

Technical Fibre Case Inc.
708 Broadway
New York, N.Y. 10003
- Storage and carrying cases

Technical Service
Magnetic Products Division
3M Company
3M Center
St. Paul, Minn. 55101
-VTR tape information.

United Nations Development Support Communication Service
10 Thra Atit Road
P.O. Box 2-147
Bangkok, Thailand
- Information and assistance to media programs in S.E. Asia; both hardware and software.

Volunteers in Technical Assistance
3706 Rhode Island Ave.
Mt. Rainier,
Maryland 20822
-Information

Chief Medical Officer for Educational Communication Systems
Division of Manpower Development
World Health Organization (WHO)
1211 Geneva 27
Switzerland

USEFUL PERIODICALS.

American Cinematographer
1782 North Orange Drive, Los Angeles
California 90028

Audio-Visual Instruction
1201 Sixteenth Street, N.W.
Washington, D.C. 20036

Audio Visual Magazine
P.O. Box 109, Croydon CR9 1QH
England

Canadian Technical and Scientific Information News Journal
Suite 2A, 1509 Sherbooke St. West
Montreal, Quebec 109, Canada

Film Making
Wessex House, 26 Station Road
Cambridge CB1 2LB, England

Challenge for Change Newsletter
National Film Board of Canada
P.O. Box 6100, Montreal 101,
Quebec, Canada

Communications Magazine
1900 West Yale, Englewood
Colorado 80110

"etc"
Association for Educational Communications and Technology
1201 16th Street, N.W.
Washington, D.C. 20036

Filmakers Newsletter
80 Wooster Street, New York,N.Y. 10012

INFORMATION
British Medical Association
Department of Visual Communication
B.M.A. House, Tavistock Square
London WC1H 9JP, England

Learning Resources
Association for Educational Communications and Technology
1201 16th Street, N.W.
Washington, D.C. 20036

Movie Maker
13-35 Bridge Street
Hemel Hempstead
Hertfordshire, England

Photographic Applications in Science and Technology and Medecine
250 Fulton Avenue
Hempstead, N.Y. 11550

PTN Master Buying Guide
250 Fulton Avenue
Hempstead, N.Y. 11550

Radical Software Magazine
Suite 1304, 440 Park Avenue South
New York, N.Y. 10016

Society of Motion Picture and Television Engineers Journal (SMPTE Journal)
9 East 41st Street
New York, N.Y. 10017

Technical Photography
250 Fulton Avenue
Hempstead, N.Y. 11550

Today's Film Maker
250 Fulton Avenue
Hempstead, N.Y. 11550

Video 1000
Vida International
54 Park Avenue, New York, NY 10016

World Neighbors Newsletter
5116 North Portland
Oklahoma City, Oklahoma 73112

BIBLIOGRAPHY

American Cinematographer's Handbook and Reference Guide, by Arthur C. Millerm and Walter Strenge. Hollywood, California.

Audio Visual Planning Equipment. Kodak Publication S-11.

Basic Magnetic Sound Recording for Motion Pictures. Kodak S-27.

Basic Production Techniques for Motion Pictures. Kodak P-18

Creative Filmmaking, by Kirk Smallman. Bantam Books, Macmillan Company, New York, 10022.

Film and Its Techniques, by Raymond Spottiswood. University of California Press, Berkeley.

Guide to Filmmaking, by Edward Pincus. Signet Series, The New American Library, New York, 10019.

Index to Kodak Technical Information. Kodak L-5.

Introducing the Single Camera VTR System, by Grayson Mattingly and Welby Smith. Smith-Mattingly Publications, P.O. Box 31096, Washington, D.C. 20031.

Kodak Publications List (Audio Visual and Motion Pictures), No.MPE-1. Eastman Kodak Company, Department 412L, Rochester, N.Y. 14650.

Notes on Tropical Photography. Kodak C-24.

Photography in the Tropics. Kodak GN-5.

Repair and Storage of Eastman Kodak 16mm Motion Picture Films. Kodak D-23.

Storage and Preservation of Motion Picture Film. Kodak.

The Techniques of Television Production, by Gerald Millerson. Communication Arts Books, Hastings House, Inc., New York.

The Video Handbook. Media Horizons Inc., 750 Third Ave. N.Y. 10017.

Video Tape Recording, by Charles Bensinger. Petersens Publishing Company, 8490 Sunset Blvd., Los Angeles, California 90069.